REMARKS

Status of the clams:

With the above amendments, claims 1 and 2 have been amended. Claims 1-10 are pending with claim 10 having been withdrawn from a restriction requirement. Thus, claims 1-9 are ready for further action on the merits. No new matter has been added by way of the above amendments. Claims 1 and 2 have been amended to more clearly recite product claims. These are non-narrowing amendments. Reconsideration is respectfully requested in light of the following remarks.

Restriction

The Examiner has set out a restriction requirement saying that claims 1-9 are in Group I and are directed to an epitaxial overgrowth structure and claim 10 is in Group II and is directed to a method of making an epitaxial overgrowth structure. The Examiner asserts that because an action on the merits has been sent on Group I that it is constructively elected. Applicants traverse the restriction. Applicants submit that if the epitaxial overgrowth structure is new and non-obvious that the method of making the epitaxial overgrowth structure must also be new and non-obvious. Thus, should the product claims issue, Applicants respectfully request that the method of making claims

issue in accordance with the holding in *In re Ochiai*, 37 USPQ2d 1127 (Fed. Cir. 1995)).

Rejections under 35 USC §§102 and 103

Claims 1-3, 5, 6, 8, and 9 are rejected under 35 §102(e) as being anticipated by Mauk '088 (US Patent No. 5,828,088).

Claims 4 and 7 are rejected under 35 §103(a) as being unpatentable over Mauk '088.

Applicants traverse all of the above rejections.

Present Invention

The present invention relates to a III-V compound semiconductor having a first layer that comprises a first III-V compound semiconductor expressed by the general formula $In_uGa_vAL_wN$ where $0 \leq u \leq 1$, $0 \leq v \leq 1$, $0 \leq w \leq 1$, and $u+v+w=1$. The pattern on the first layer is from a material different not only from said first III-V compound semiconductor but also from a second III-V compound semiconductor layer. The layer on the first III-V compound semiconductor and the pattern from the second III-V compound semiconductor are expressed by the general formula $In_xGa_yAl_zN$ where $0 \leq x \leq 1$, $0 \leq y \leq 1$, $0 \leq z \leq 1$, and $x+y+z=1$. The full width at half maximum of the (0004) reflection X-ray rocking curve of the second III-V compound semiconductor is 700 seconds or less regardless of the direction of X-ray incidence, and the

compound semiconductor is formed by a vapor phase epitaxy method.

Disclosure of Mauk '088

Mauk '088 discloses a device structure and crystal growth process for making the same. The single-crystal semiconductor layers are formed over metal or composite layers. The metal layers function as buried reflectors to enhance the performance of LEDs, solar cells, and photodiodes. The structures are made by a modification of a well-established metallic solution growth process. The lateral overgrowth process can be enhanced by imposing an electric current at the growth interface (termed liquid-phase electro-epitaxy). However, the use of an electric current is not crucial. The epitaxial lateral overgrowth technique was also applied to silicon growth on metal-masked silicon substrates.

Mauk '088 fails to disclose a compound semiconductor that is formed by a vapor phase epitaxy method.

Removal of the Rejection over Mauk '088

The Examiner asserts that because the claims are product-by-process claims, the process is not read into the product, and thus the an element such as wherein "a compound semiconductor that is formed by a vapor phase epitaxy method" is not read into

the claims. Applicants assert that this "process" element imparts physical differences between the instantly claimed invention and the disclosure of Mauk '088.

First, it is pointed out that Mauk '088 does not disclose or suggest using a vapor phase epitaxy method.

Second, the vapor phase epitaxy method of the instant invention is fundamentally different from the liquid phase epitaxy method as disclosed in Mauk '088 and these differences impart physical differences between the invention of Mauk '088 and the instant invention.

Third, the difference in a vapor phase epitaxy method and a liquid phase epitaxy method is shown in the attached figure. These differences lead to physical differences in the compound semiconductors of the instant invention and the invention of Mauk '088.

In the present invention, after a mask pattern is formed on a first III-V compound semiconductor layer, then a second III-V compound semiconductor layer is formed (selective growth) thereon. Here, the mask pattern is different not only from the first GaN layer but also from a second GaN layer. The full width at half maximum of the (004) reflection X-ray rocking curve of the second III-V compound semiconductor is 700 seconds or less regardless of the direction of X-ray incidence. Thus, thin film having improved crystal quality can be obtained.

In liquid phase epitaxy of GaAs or Si (as disclosed in Mauk '088), it has been shown that the disclocation originated from a ground layer is stopped by a mask and the dislocation in the selective-growth layer is lowered. New dislocation does not occur at this time. Please see the attached figure 4(c) in Jpn. J. Appl. Phys. Vol. 28, (1989), pp. L337-339 wherein this is demonstrated.

In contrast, in vapor growth of GaN, although the threading dislocation is stopped by a mask, it has been known that a new crystal defect occurs in the selective growth, that is, inclination of the crystal axis in the selective growth layer occurs.

Accordingly, as can be seen in the attached figure 4(c), the c-axis direction of the window portion is the same width as that of the ground layer, the c-axis on the right above portion of the mask pattern tends to incline towards the center of the mask, and the resulting crystal defect called small angle tilt boundary occurs at this boundary. These crystal defects generated in ELO by vapor growth of a nitride type semiconductor are not known for ELO by conventional LPE (liquid phase epitaxy) of GaAs of Si.

In contrast, according to the growth method of the instant invention, it is thought that, since the inclination of the c-

axis in a selective growth layer is suppressed, the generation of a small angle tilt boundary is suppressed.

Thus, the characteristic of the present invention exists in suppression of the fluctuation of the c-axis, which can be see in the full width at half maximum of the reflection X-ray rocking curve.

For the above reasons, the element "the compound semiconductor is formed by a vapor phase epitaxy method" should be read into the claim because this element imparts physical differences to the instant invention that are different from the invention of Mauk '088. For these reasons, the rejections over Mauk '088 are inapposite. Withdrawal of the rejections is warranted and respectfully requested.

With the above remarks and amendments, it is believed that the claims, as they now stand, define patentable subject matter such that a passage of the instant invention to allowance is warranted. A Notice to that effect is earnestly solicited.

Pursuant to 37 C.F.R. §§ 1.17 and 1.136(a), Applicant(s) respectfully petition(s) for a three (3) month extension of time for filing a reply in connection with the present application, and the required fee of $930.00 is attached hereto.

If any questions remain regarding the above matters, please contact Applicant's representative, T. Benjamin Schroeder (Reg. No. 50,990), in the Washington metropolitan area at the phone number listed below.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

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By _____

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ADM/TBS/crt

Attachments

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

The claims have been amended as follows:

1. (Amended) A III-V compound semiconductor having a first layer [formed from] that comprises a first III-V compound semiconductor expressed by the general formula $In_uGa_vAL_wN$ where $0 \leq u \leq 1$, $0 \leq v \leq 1$, $0 \leq w \leq 1$, and $u+v+w=1$, a pattern [formed] on said first layer from a material different not only from said first III-V compound semiconductor but also from a second III-V compound semiconductor hereinafter described, and a layer [formed] on said first III-V compound semiconductor and said pattern from said second III-V compound semiconductor expressed by the general formula $In_xGa_yAl_zN$ where $0 \leq x \leq 1$, $0 \leq y \leq 1$, $0 \leq z \leq 1$, and $x+y+z=1$, wherein the full width at half maximum of the (0004) reflection X-ray rocking curve of said second III-V compound semiconductor is 700 seconds or less regardless of the direction of X-ray incidence, and the compound semiconductor is formed by a vapor phase epitaxy method.

2. (Amended) A III-V compound semiconductor having a first layer [formed from] that comprises a first III-V compound semiconductor expressed by the general formula $In_uGa_vAL_wN$ where $0 \leq u \leq 1$, $0 \leq v \leq 1$, $0 \leq w \leq 1$, and $u+v+w=1$, a pattern [formed] on said

first layer from a material different not only from said first III-V compound semiconductor but also from a second III-V compound semiconductor hereinafter described, and a layer [formed] on said first III-V compound semiconductor and said pattern from said second III-V compound semiconductor expressed by the general formula $In_xGa_yAl_zN$ where $0 \leq x \leq 1$, $0 \leq y \leq 1$, $0 \leq z \leq 1$, and $x + y + z = 1$, wherein an upper surface of said pattern is not in contact with said second III-V compound semiconductor, and the compound semiconductor is formed by a vapor phase epitaxy method.